Claims

1. An isolated DNA molecule, **characterised** in that it comprises a gene encoding an enzyme protein which has an NADH dependent L-xylulose reductase activity.

2. An isolated DNA molecule according to claim 1, **characterised** in that the enzyme protein has a catalytic activity for the reversible conversion of a sugar which bears a keto group at carbon 2 (C2 position), to a sugar alcohol bearing a hydroxyl group at C2 in L-configuration in a Fischer projection.

3. An isolated DNA molecule according to claim 1, **characterised** in that the enzyme protein comprises an amino acid sequence of SEQ ID No. 2 or a functionally equivalent derivative thereof.

4. An isolated DNA molecule according to claim 1, **characterised** in that the enzyme protein is NADH dependent L-xylulose reductase of fungal origin.

5. An isolated DNA molecule according to claim 1, **characterised** in that said fungal origin is *Ambrosiozyma monospora.*

6. An isolated DNA molecule according to claim 1, **characterised** in that the gene comprises a nucleic acid sequence of SEQ ID No. 1 or a functionally equivalent derivative thereof.

7. An isolated DNA molecule according to claim 1, **characterised** in that the NADH dependent L-xylulose reductase exhibits a catalytic activity for reversible conversion of xylulose to xylitol.

8. A vector comprising the DNA molecule according to claim 1.

9. A genetically modified microorganism transformed with the DNA molecule according to claim 1 for expressing said NADH dependent L-xylulose.

10. A genetically modified microorganism according to claim 9, **characterised** in that it has an ability to utilise a sugar or a sugar alcohol.

11. A genetically modified microorganism according to claim 10, **characterised** in that it has an ability to utilise L-arabinose.

12. A genetically modified microorganism according to claim 9, **characterised** in that the microorganism produces derivatives of at least one of fungal L-arabinose pathway or of pentose phosphate pathway.

13. A genetically modified microorganism according to claim 9, **characterised** in that the microorganism contains at least genes of a fungal L-arabinose pathway, which encode enzymes of aldose reductase and of L-arabinitol 4-dehydrogenase, for expression thereof.

14. A genetically modified microorganism according to claim 13, **characterised** in that the microorganism contains genes of the fungal L-arabinose pathway, which encode enzymes of at least one of D-xylulose reductase or xylulokinase.

15. The microorganism of claim 14 further including genes encoding of D-xylulose of pentose phosphate pathway.

16. A genetically modified microorganism according to claim 9, **characterised** in that the microorganism produces at least one of arabinitol, xylitol, ethanol or lactic acid.

17. A genetically modified microorganism according to claim 9, **characterised** in that the genetically modified microorganism is a fungus.

18. The microorganism of claim 17 wherein the fungus is a yeast or a filamentous fungus.

19. A genetically modified microorganism according to claim 18, **characterised** in that the yeast is a strain of *Saccharomyces* species, *Schizosaccharomyces* species, *Kluyveromyces* species, *Pichia* species, *Candida* species or *Pachysolen* species.

20. A genetically modified microorganism according to claim 19, **characterised** in that the strain is *S. cerevisiae*.

21. A genetically modified microorganism according to claim 18, **characterised** in that the filamentous fungus is strain of *Aspergillus* species, *Trichoderma* species, *Neurospora* species, *Fusarium* species, *Penicillium* species, *Humicola* species, *Tolypocladium geodes*, *Trichoderma reesei* (*Hypocrea jecorina*), *Mucor* species, *Trichoderma longibrachiatum*, *Aspergillus nidulans*, *Aspergillus niger* or *Aspergillus awamori*.

22. A method for producing a fermentation product from a carbon source comprising a carbohydrate, **characterised** in that the method includes steps of culturing a genetically modified microorganism according to claim 9 in presence of a carbon source under fermentation conditions.

23. A method according to claim 22, **characterised** in that the carbon source comprises L-arabinose.

24. A method according to claim 22, **characterised** in that the carbon source comprises L-arabinose and the fermentation product is selected from a product of a fungal L-arabinose pathway and a product of a pentose phosphate pathway.

25. An enzyme protein which has an NADH dependent L-xylulose reductase activity and comprises an amino acid sequence encoded by a gene of a DNA molecule of claim 1.

26. An enzyme protein according to claim 25, **characterised** in that the enzyme protein comprises an amino acid sequence of SEQ ID No. 2 or a functionally equivalent derivative thereof.

27. An *in vitro* enzymatic preparation for producing conversion products from a carbon source, **characterised** in that said preparation comprises an enzyme protein which comprises an amino acid sequence encoded by DNA molecule according to claim 1.

28. A method of conversion of a sugar comprising contacting the sugar with an NADH dependent L-xylulose reductase enzyme, comprising an amino acid sequence encoded by a gene of a DNA molecule of claim 1, wherein the sugar has a keto group at C2 position and is converted to a sugar alcohol with a hydroxyl group at C2 in L-configuration in a Fischer projection, or for reversed conversion thereof.

29. The method of claim 28, **characterised** in that the enzyme is produced by a genetically engineered microorganism in a fermentation medium which comprises the sugar or the sugar alcohol, in fermentation conditions that enable conversion by said enzyme.

30. The method of claim 28, **characterised** in that the conversion is an *in vitro* enzymatic conversion.